

REMARKS / DISCUSSION OF ISSUES

The present amendment is submitted in response to the Office Action mailed August 24, 2009. In view of the remarks to follow and amendments above, reconsideration and allowance of this application are respectfully requested.

Status of Claims

Claims 1-16 remain in this application. Claims 1-16 have been amended. Claim 7 has been cancelled without prejudice or disclaimer. The claims in general are amended for one or more non-statutory reasons, for example to correct one or more informalities or obvious errors, remove figure label numbers, remove unnecessary limitations, and /or replace European claim phraseology with U.S. claim language having the same meaning. The claims are not believed to be narrowed in scope and no new matter is added.

The Invention

The present invention is directed to the use of “physically unclonable functions” (PUFs) for security purposes. Incorporating a PUF into a product such as a smartcard, chip, or storage medium makes it extremely difficult to produce a “clone” of the product. “Clone” means either a physical copy of the product or a model that is capable of predicting the input-output behavior of the product with reliability. The difficulty of physical copying arises because the PUF manufacturing is an uncontrolled process (e.g., epoxy scattering material including micron sized particles embedded therein) and the PUF is a highly complex object. Accurate modeling is extremely difficult because of the PUF’s complexity; slightly varying the input results in widely diverging outputs. The uniqueness and complexity of PUFs makes them well suited for identification, authentication or key generating purposes. The present invention is based on the recognition that in order to hamper an attempt to clone an identifier by challenging it with all possible challenges and to store the detected responses, it is possible, in alternative or in addition to enlarging the challenge space, to **extend the time required to obtain a single response, so that the time for making a model is too long for a realistic hacking scenario, e.g., several years**. It has been found that the time for obtaining a single measurement could be extended simply by using a light absorbing means for reducing the intensity of the incident light beam, which is preferably a laser beam generated by a laser.

This light absorbing means is arranged next to the optical scattering medium, either before the light beam impinges on the scattering medium or after the light beam has passed the scattering medium. The light absorbing means extends the integration time needed for obtaining response signals, making the identifier more secure.

Objection to the Abstract:

In the Office Action, the abstract of the disclosure was objected to because it includes reference numbers. By means of the present amendment, the current Abstract has been amended as shown in the enclosed Replacement Abstract in a manner which is believed to overcome the objection. Withdrawal of the objection is respectfully requested.

Specification Objection

In the Office Action, the Specification was objected to for failing to include section headings. Applicants respectfully decline to add headings as they are not required in accordance with MPEP §608.01(a).

Claim Rejections under 35 USC 102

In the Office Action, Claims 1, 6, 8, 9 and 16 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,983,817 (“Dolash”). Applicants respectfully traverse the rejections.

Claims 1, 6, 8, 9 and 16 are allowable

Independent Claim 1 has been amended herein to better define Applicant’s invention over Dolash. Claim 1 has been amended in part to incorporate the subject matter of now-cancelled claim 7. In addition to incorporating the subject matter of claim 7, Claim 1 has been further amended to more precisely and specifically claim the invention. It is therefore respectfully submitted that Claim 1 now recites limitations and/or features which are not disclosed by Dolash. Accordingly, the cited portions of Dolash do not anticipate claim 1, because the cited portions of Dolash fail to disclose every element of claim 1. For example, the cited portions of Dolash fail to disclose or suggest, *“Information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it”*

with all possible challenges and storing the detected responses; said optical scattering medium comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, said optical scattering means for being challenged by a light beam passing through said optical scattering medium and for scattering said light beam, and said light absorbing means for reducing the intensity of said light beam passing there-through so that an integration time for obtaining a response signal by integrating the light beam scattered is extended”, as recited in claim 1. [Emphasis Added]

It is respectfully submitted that a careful examination of Dolash will show that the recitations of claim 1, as herewith amended, are clearly not met. While it is recognized that the cited and applied art is generally in the same very broad field of endeavor with regard to utilizing light (laser) beams, Applicants respectfully submit that Dolash and the present invention are directed to very different aspects of this broad field. Dolash, on the one hand, solves the problem of reading a luminescent and substantially transparent bar code 1 on a background surface 2 whose reflectance may vary over the coded area, while the invention solves the problem of preventing a hacker from producing a clone of a product such as a smartcard, chip, or storage medium, through the use of “physically unclonable functions” (PUFs). Claim 1 as amended now more clearly and precisely recites the functions performed by the present invention to achieve the stated objectives. Specifically, Claim 1 as amended now recites in relevant part, As a first point of distinction, Claim 1 as amended now more clearly and precisely recites in relevant part - “*an information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it with all possible challenges and storing the detected responses.*

In further contrast to Dolash, claim 1 as amended now more clearly and precisely recites that a challenging light beam **passes through the optical scattering medium** and scatters the light beam, whereby the *light absorbing means comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, via micron-scale scattering particles contained within the optical scattering medium*. Applicant’s specification recites at page 4, lines 20-23, “*The*

laser beam 5 propagates with reduced intensity through the epoxy 3 and is scattered by scattering particles (not shown) contained in the epoxy 5 resulting in a scattered laser beam 8." It should be understood that the specification refers to the epoxy 3 as one embodiment of the optical scattering medium.

In the Office Action, the Examiner analogizes the optical scattering medium of the invention to the envelope having the phosphorescent ink in Dolash. In light of the amendments to claim 1 it is submitted that the analogy is no longer applicable in that **Dolash does not teach** that the laser beam **passes through the envelope** having the phosphorescent ink. Instead, Dolash teaches a method and apparatus for reading a luminescent and substantially transparent bar code 1 on a background surface 2 whose reflectance may vary over the coded area. Light 7 scans (70), and **excites luminescence 8 in, the bar code 1.** The **light 7 also reflects (9) without luminescence from the background surface 2 of the bar code 1.** It is therefore shown that Dolash teaches that the light both reflects over the coded area in different degrees and excites luminescence in the bar code. Dolan does not teach that the laser beam passes through either of the bar code or the envelope.

Further, claim 1 as amended more clearly and precisely recites that the light absorbing means is arranged next to the optical scattering medium. In the Office Action, the Examiner analogizes the light absorbing means to the phosphorescent ink and the envelope to the optical scattering medium. In such a configuration, the light absorbing means and optical scattering medium are essentially integrated in the sense that that the ink is embedded into the envelope. It is respectfully submitted that ink embedded on an envelope is different from the light absorbing means being attached to the optical scattering means. That is, "embedded" or "embedded within" has a different meaning than "attached to". Specifically, "attached to" implies an agent for making the attachment that can be removed to thereby easily separate the two entities while preserving their separate identities. Ink does not represent a detachable entity that is preservable as a separate standalone entity.

Further, claim 1 as amended recites that light passes through the light absorbing means. The Examiner analogizes the phosphorescent ink of Dolash to the light absorbing means of the invention. Accordingly, it is respectfully submitted that Dolash differs from the

present invention in that **Dolash does not teach or suggest** that light **passes through** the phosphorescent ink. Page 4 of Applicant's specification discloses a reading apparatus for reading the information carrier 1 comprises mainly the laser 13 and a detector 6. The smartcard 1 with the non-clonable optical identifier 2 and the reading apparatus are arranged such that the laser beam 5 shines on the **gray filter 4 (i.e., light absorbing means)** which thus reduces the intensity of the laser beam 5. **The laser beam 5 propagates with reduced intensity through the epoxy 3** and is scattered by scattering particles (not shown) contained in the epoxy 5 resulting in a scattered laser beam 8. It is therefore shown that the laser beam passes through the gray filter 4 (light absorbing means) and thereafter propagates with reduced intensity through the epoxy 3. In other words, the light beam passes through each of the light absorbing means and scattering means resulting in a scattered laser beam 8. Dolash does not teach light passing through the phosphorescent ink. Instead, Dolash teaches that **light excites (is absorbed by) the phosphorescent ink**. As stated above, Dolash teaches, *Light 7 scans (70), and excites luminescence 8 in, the bar code 1. The light 7 also reflects (9) without luminescence from the background surface 2 of the bar code 1.* Hence, claim 1 is allowable.

Claims 6, 8, 9 and 16 depend from independent Claim 1 and therefore contains the limitations of Claim 1 and is believed to be in condition for allowance for at least the same reasons given for Claim 1 above. Accordingly, withdrawal of the rejection under 35 U.S.C. §102(b) and allowance of Claims 6, 8, 9 and 16 is respectfully requested.

Claim 2 is allowable

In the Office Action, Claim 2 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Dolash and further in view of U.S. Patent No. 3,836,754 ("Toye"). Applicants respectfully traverse the rejection.

As explained above, the cited portions of Dolash do not disclose or suggest each and every element of claim 1 from which claim 2 depends. Toye does not disclose each of the elements of claim 1 that are not disclosed by Dolash. For example, Toye does not disclose or suggest, Toye is cited by the Office for disclosing a gray filter. Toye discloses that in place of colors, gray filters of various light transmissivities may be used.

Thus, the cited portions of Dolash and Toye, individually or in combination, do not disclose or suggest “*Information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it with all possible challenges and storing the detected responses; said optical scattering medium comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, said optical scattering means for being challenged by a light beam passing through said optical scattering medium and for scattering said light beam, and said light absorbing means for reducing the intensity of said light beam passing there-through so that an integration time for obtaining a response signal by integrating the light beam scattered is extended*”, as recited in claim 1. [Emphasis Added]

Claim 3 is allowable

In the Office Action, Claim 3 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Dolash and further in view of U.S. Patent No. 5,510,163 (“Sullivan”). Applicants respectfully traverse the rejection.

As explained above, the cited portions of Dolash do not disclose or suggest each and every element of claim 1 from which claim 3 depends. Sullivan does not disclose each of the elements of claim 1 that are not disclosed by Dolash. For example, Sullivan does not disclose or suggest, “*Information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it with all possible challenges and storing the detected responses; said optical scattering medium comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, said optical scattering means for being challenged by a light beam passing through said optical scattering medium and for scattering said light beam, and said light absorbing means for reducing the intensity of said light beam passing there-through so that an integration time for obtaining a response signal by integrating the light beam scattered is extended*”, as recited in claim 1. [Emphasis Added] Sullivan is cited by the

Office for disclosing a phase change medium, where the recording coating has at least one-phase change layer having a crystal state that can be changed by a laser beam.

Thus, the cited portions of Dolash and Sullivan, individually or in combination, do not disclose or suggest "*Information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it with all possible challenges and storing the detected responses; said optical scattering medium comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, said optical scattering means for being challenged by a light beam passing through said optical scattering medium and for scattering said light beam, and said light absorbing means for reducing the intensity of said light beam passing there-through so that an integration time for obtaining a response signal by integrating the light beam scattered is extended*"", as recited in claim 1. [Emphasis Added] Hence claim 1 is allowable and claim 3 is allowable, at least by virtue of its respective dependence from claim 1.

Claims 4, 5 and 7 are allowable

In the Office Action, Claims 4, 5 and 7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Dolash and further in view of U.S. Patent Application No. 2002/0089709 ("Mays Jr."). Claim 7 has been cancelled without prejudice or disclaimer. Applicants respectfully traverse the remainder of the rejections.

Applicants note that the Examiner has failed to make a specific rejection of claim 7 in the Office Action. See Office Action, pages 4-5, bullet item no. 8. In the rejection of claims 4, 5 and 7, the Examiner asserts that Dolash fails to teach a photo layer, which is recited in claims 4 and 5 only. Claim 7 is directed to a particular implementation of the light absorbing means, namely, the light absorbing means comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material. In the Office Action, the Examiner fails to point out where this feature is taught in any of the cited references. Applicants therefore respectfully submit that the features of dependent claim 7, which have been incorporated into claim 1, are novel.

Further, as explained above, the cited portions of Dolash do not disclose or suggest each and every element of claim 1 from which claims 4, 5 and 7 depend. Mays Jr. does not disclose each of the elements of claim 1 that are not disclosed by Dolash. For example, Mays Jr. does not disclose or suggest, “*Information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it with all possible challenges and storing the detected responses; said optical scattering medium comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, said optical scattering means for being challenged by a light beam passing through said optical scattering medium and for scattering said light beam, and said light absorbing means for reducing the intensity of said light beam passing there-through so that an integration time for obtaining a response signal by integrating the light beam scattered is extended*”, as recited in claim 1. [Emphasis Added] Mays Jr. is cited by the Office for disclosing a photo layer.

Thus, the cited portions of Dolash and Mays Jr., individually or in combination, do not disclose or suggest “*Information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it with all possible challenges and storing the detected responses; said optical scattering medium comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, said optical scattering means for being challenged by a light beam passing through said optical scattering medium and for scattering said light beam, and said light absorbing means for reducing the intensity of said light beam passing there-through so that an integration time for obtaining a response signal by integrating the light beam scattered is extended*”, as recited in claim 1. [Emphasis Added] Hence claim 1 is allowable and claims 4, 5 and 7 are allowable, at least by virtue of their respective dependence from claim 1.

Claims 10-13 and 15 are allowable

In the Office Action, Claims 10-13 and 15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Dolash and further in view of U.S. Patent No. 4,013,894 (“Foote”). Applicants respectfully traverse the rejection.

As explained above, the cited portions of Dolash do not disclose or suggest each and every element of claim 1. Foote does not disclose each of the elements of claim 1 that are not disclosed by Dolash. For example, Foote Jr. does not disclose or suggest, “*Information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it with all possible challenges and storing the detected responses; said optical scattering medium comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, said optical scattering means for being challenged by a light beam passing through said optical scattering medium and for scattering said light beam, and said light absorbing means for reducing the intensity of said light beam passing there-through so that an integration time for obtaining a response signal by integrating the light beam scattered is extended*”, as recited in claim 1. [Emphasis Added] The Office cites Foote for remedying a deficiency in Dolash. Specifically, Foote is cited for teaching comparing a stored response signal with a response signal, where the stored response signal is associated with a corresponding challenge signal.

Thus, the cited portions of Dolash and Foote, individually or in combination, do not disclose or suggest “*Information carrier containing a non-clonable optical identifier comprising: an optical scattering medium and a light absorbing means for hampering an attempt to clone the information carrier by challenging it with all possible challenges and storing the detected responses; said optical scattering medium comprising a scattering material having a low light transmittance or reflectance, containing scattering particles of phase-change material or photo-effect material, said optical scattering means for being challenged by a light beam passing through said optical scattering medium and for scattering said light beam, and said light absorbing means for reducing the intensity of said*

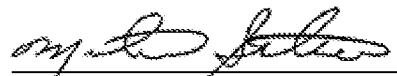
light beam passing there-through so that an integration time for obtaining a response signal by integrating the light beam scattered is extended", as recited in claim 1. [Emphasis Added] Hence independent claims 10 and 15, as amended herewith, are allowable, as amended herewith, in that they recite similar subject matter as Independent Claim 1 and therefore contain the limitations of Claim 1. Hence, for at least the same reasons given for Claims 1, Claims 10 and 15 are believed to recite statutory subject matter under 35 USC 103(a) and claims 11-13 are allowable, at least by virtue of their respective dependence from claim 10.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that all claims presently pending in the application, namely, Claims 1-16 are believed to be in condition for allowance and patentably distinguishable over the art of record.

If the Examiner should have any questions concerning this communication or feels that an interview would be helpful, the Examiner is requested to call Mike Belk, Esq., Intellectual Property Counsel, Philips Electronics North America, at 914-945-6000.

Respectfully submitted,



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